vol. III no. 6

February, 1944

School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

Automotive Maintenance Training
by William J. Micheels and Walter E. Keyes

A Tool-Post Turret
by Jon P. Adams and M. B. Goodwin

Radio Instruction in the High School
by Helge E. Hansen

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FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

The Cover . . . . .

Meet Henry and Ford. These twins graduated recently from the Henry Ford Trade School, Dearborn, Michigan. Shown operating a boring machine at the school, the boys are Henry and Ford Lawrence. They happened to be the first twins born at the Henry Ford Hospital in Detroit so their parents gave them the name of the pioneer Detroit automobile maker, little suspecting that some day they would graduate from the trade school of the same name.

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CONTENTS

February, 1944
Vol. III, No. 6

Automotive Maintenance Training in the Schools. William J. Micheels and Walter E. Keyes 3
Some schools are doing an excellent job of cooperating with local transportation industries for the training of workers in the automotive field. This article describes the program.

Project of the Month: A Tool-Post Turret. Jon P. Adams and M. B. Goodwin 8
This excellent project can be used to teach many machine-shop operations and culminates in a useful piece of equipment for the school.

Radio Instruction in the High School. Helge E. Hansen 10
Teachers of preinduction radio will find many useful hints from the experiences of the author who manages to teach a large proportion of the fundamentals and give much laboratory work in spite of serious time limitations.

Shop Teachers' Service—Free and Low-Cost Teaching Aids 15
This annual service brings together teaching aids and news on equipment which will interest shop teachers generally. A handy coupon is supplied so that items may be requested with a minimum of inconvenience. Send in your request today.

Detroit Teaches Aero Mechanics. Walter J. Larson 18
CAA certification of aero mechanics requires careful preparation. Detroit has established a new high school for this specific purpose.

Repairing an Old Ruling Pen. Wallace I. Victoria 21
Here is a hint for salvaging ruling pens that have lost their spring.

Strictly Personal 21
About your fellow teachers.

In the Morning Mail 22
Comments from readers.

News 24
What's happening in the field of education.

Are They Harmful? Mark B. Levinson 26
A contrasting viewpoint on drawing to that of Mr. Stern.

Clothes-Line Reel. N. H. Poole 28
This simple woodworking project is excellent for teaching beginning shop students.

Instructional Resources: Books, Pamphlets, Visual Aids 30
Listings in easy form for clipping, pasting to cards, and filing. Keep your industrial education bibliographies up-to-date.

from Washington. Michael Paca 32
News from the Nation's Capital of interest to shop teachers.

Index to Advertisers 32

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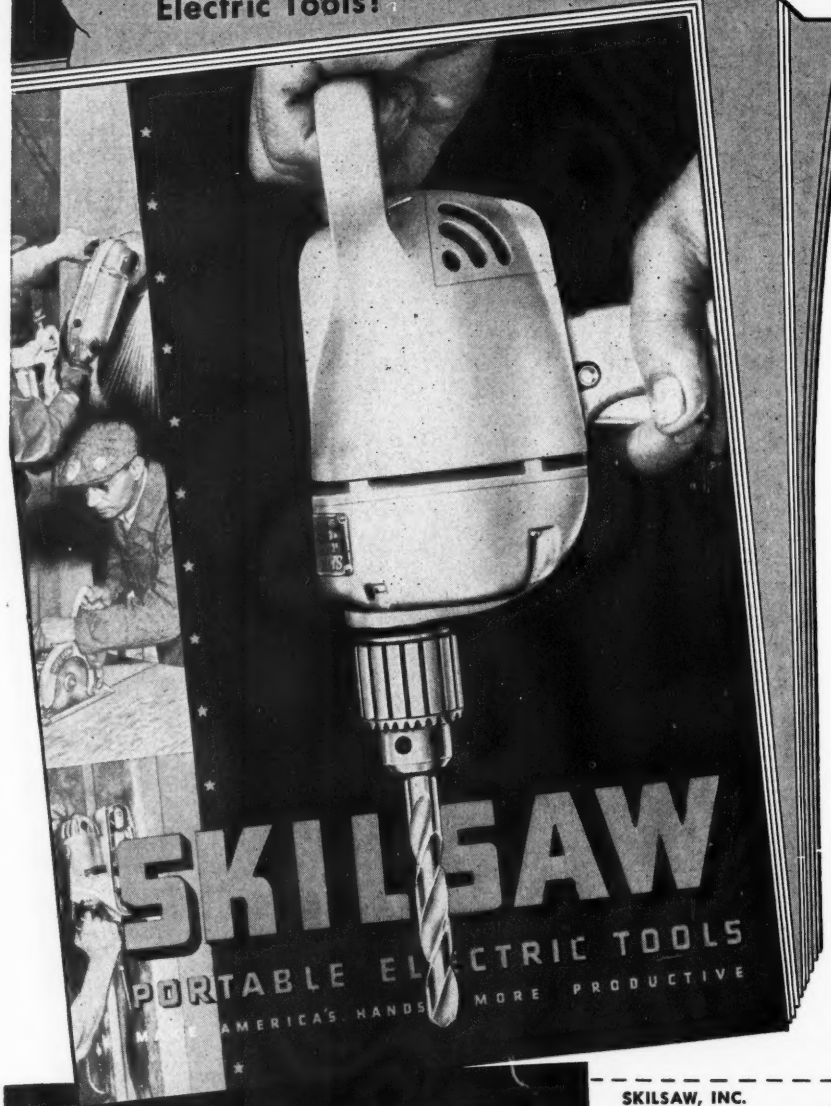

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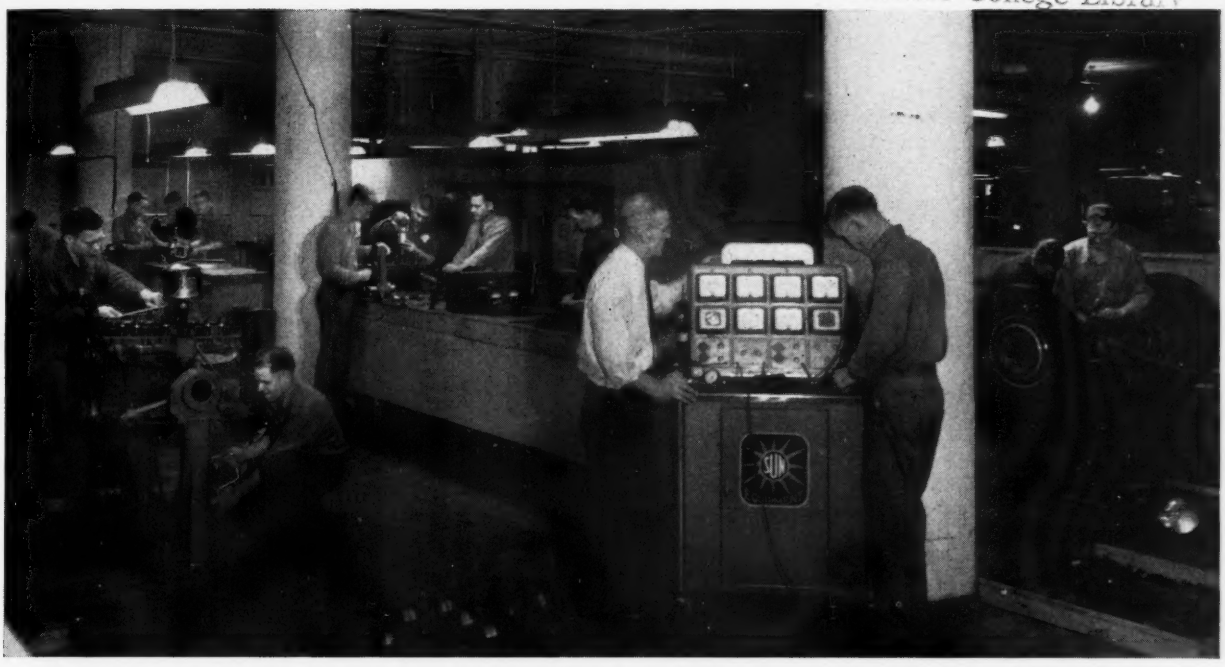

A training class of Chevrolet automotive mechanics at the St. Paul, Minn., Vocational School, an example of cooperation between industry and the schools.

Automotive Maintenance Training in Schools

BY *William J. Micheels*
AND *Walter E. Keyes*

TRANSPORTATION is, in one respect, like the air we breathe or the water we drink—it is taken pretty much for granted until the service is restricted or completely eliminated. Because of the numerous inconveniences of present-day travel most persons are now aware of the essential part the transportation industry is playing in the carrying of passengers. Few, however, fully realize the gigantic job that is being accomplished in the transport of war and civilian commodities. Railroads, trucks, busses, airlines, inland waterways, Great Lakes shipping, the private passenger car, taxicabs—these are the more important branches of this extensive and diversified industry and each is doing its share in transporting the men and materials so necessary to the winning of the war. An important segment of the industry is that of automotive maintenance which is vital to the several types of motor transportation mentioned in the above list. With no new cars on the market and with those on hand becoming older and older, the problem of effective maintenance is becoming increasingly important.

The coordination of all forms of transportation is accomplished through the efforts of the Office of Defense Transportation. This agency, under the direction of Joseph B. Eastman, is charged with the responsibility of seeing that essential transportation is kept moving and that men and materials arrive at the right place at the right time. In order to accomplish this, a variety of experts has been selected from industry to head the several operating and staff divisions of ODT.

A description of the activities of each ODT division would show the positive results that are being attained, but of interest to SCHOOL SHOP readers is the Division of Transport Personnel which handles the manpower problems that are the responsibility of the Office of Defense Transportation. These are the problems which must be met in order that there will be sufficient personnel to run the trains and vehicles and to maintain them under all conditions. Within this division is a Personnel Training Section which is responsible for the promotion and development of adequate training programs in the transportation industry. It is a liaison section working with transportation companies on the one hand and the federal and state training agencies on the other. The Personnel Training Section has no instructors; it offers no courses. Rather, it attempts to sell the value and efficiency of organized training and then inform employers as to how they can obtain such training in their own communities.

Some progress can be reported along these lines, but there is still much to be done before the many transportation companies realize and utilize the training services that are available to them. The most notable results have been attained in the field of automotive maintenance. A large share of the credit for the success to date can be given directly to the U. S. Office of Education War Production Training programs in the local vocational schools where, with few exceptions, the training is being carried out.

In a majority of communities this training is sponsored by the Maintenance Advisory Committees, one of which is

Automotive shop facilities and instructors have been enlisted by the Office of Defense Transportation for the training of workers for the critical transportation industry. This is the story of what some schools have done to help. William J. Micheels is Chief, Personnel Training Section, Division of Transport Personnel, Office of Defense Transportation, and Walter E. Keyes is Special Representative for Transportation, War Production Training Division, U. S. Office of Education.

Trainees learning motor tune-up operations at Woodward High School, Toledo, Ohio.

located in each of the 142 ODT districts. These committees, organized by the Vehicle Maintenance Section of the ODT Division of Motor Transport, have been active for some time in handling local problems concerning automotive maintenance. One of their important functions is the promotion and development of training programs to meet manpower shortages in the automotive maintenance field. A recent report showed that 83 districts now have training programs in operation and that 13 more are ready to start, which is indicative of the progress that has so far been made.

An excellent example of the manner in which the vocational schools have cooperated in this effort is the program now operating at the vocational school in Memphis, Tennessee, under the sponsorship of the local maintenance advisory committee. As plans for this program were developed and organized in the spring of 1943, a preliminary survey showed that approximately 2000 persons would have to be trained over a 12-month period in order to meet the anticipated manpower requirements for all phases of maintenance work in the community. On the basis of this survey the first courses were organized and workers were recruited to take the training.

Naturally, the proposed speeded-up training program could not turn out all-round finished mechanics, but in Memphis, as elsewhere, the intent has been first to prepare specialists who can perform certain service operations after having had a short period of organized instruction and then to provide supplementary training after they start work on the job. Typical of the first courses were the following: rear end, brakes, and carburetion given to truck mechanics; motor tune-up and motor rebuilding for lighter vehicle mechanics; and a course for the training of parts clerks. The length of the training period varies as much as from four to ten weeks depending on such factors as the job which is to be performed, the previous experience of the worker, and the type of equipment available.

Qualified instructors have been selected from the industry and given short instructor-training courses before starting to teach. Through this process they may be qualified to teach either beginning workers or those who are returning to receive some supplementary training. At the start the work was carried on in the Memphis Vocational School but later a large maintenance garage was taken over in order that heavy duty vehicles might be serviced. Lubrication specialists are trained in a filling station obtained for the purpose. Certain of the equipment needed has been obtained with War Production Training funds and industry furnishes various pieces of specialized equipment as it is needed. One instance of outside assistance is that in which a manufacturing company provided a representative to give specialized instruction to the workers who would use the particular product in their work.

The major problem in Memphis, as in most communities, has been the recruitment of new workers to be given the training and subsequent employment. To meet this difficulty a variety of methods were employed in an effort to locate individuals who would be interested in and capable of becoming automotive maintenance workers. Advertisements were run in the newspapers and over the radio, employees were asked to bring in friends and relatives, vocational school students were contacted, and the aid of the United States Employment Service was enlisted. The results, while not startling, were sufficient to get the program under way successfully. Women were included in certain of the courses, and, in line with results in other industries, they were well able to learn and perform the specialized operations for which they were trained.

In Memphis and the other communities where advisory committees are active, a significant outcome is the manner in which the industry is working together to get training courses under way. Automotive maintenance is characteristically a small-shop industry and it is sometimes difficult to secure the active cooperation of the several employers in a community. Where this has been accomplished, however, a positive manpower program has usually been forthcoming and personnel shortages have been relieved.

Experience has shown that a necessary factor in these training programs is a "live-wire" man from the industry who is willing and able to spend some time in getting things started and keeping them moving. The schools have proved that they are able to provide the type of instruction necessary to turn out competent workers who can do the specialized work expected of them. There is a constant need, however, to keep the industry informed and aware of the training being done, the problems that arise, and the results that are forthcoming. The present emergency has shown conclusively the effectiveness and efficiency of organized training as opposed to the usual hit-or-miss, pick-up methods so common in many prewar industries. Automotive maintenance and other employers must realize and understand the benefits of such training and it becomes a responsibility as well as a challenge to vocational-school authorities to see that this is accomplished.

In line with this thinking the second automotive maintenance program to be described briefly is that initiated by the St. Paul zone manager of the Chevrolet Motor Company and carried on in the St. Paul Vocational School. When the manpower situation began to get urgent this zone manager decided to visit his dealers in Minnesota, North and South

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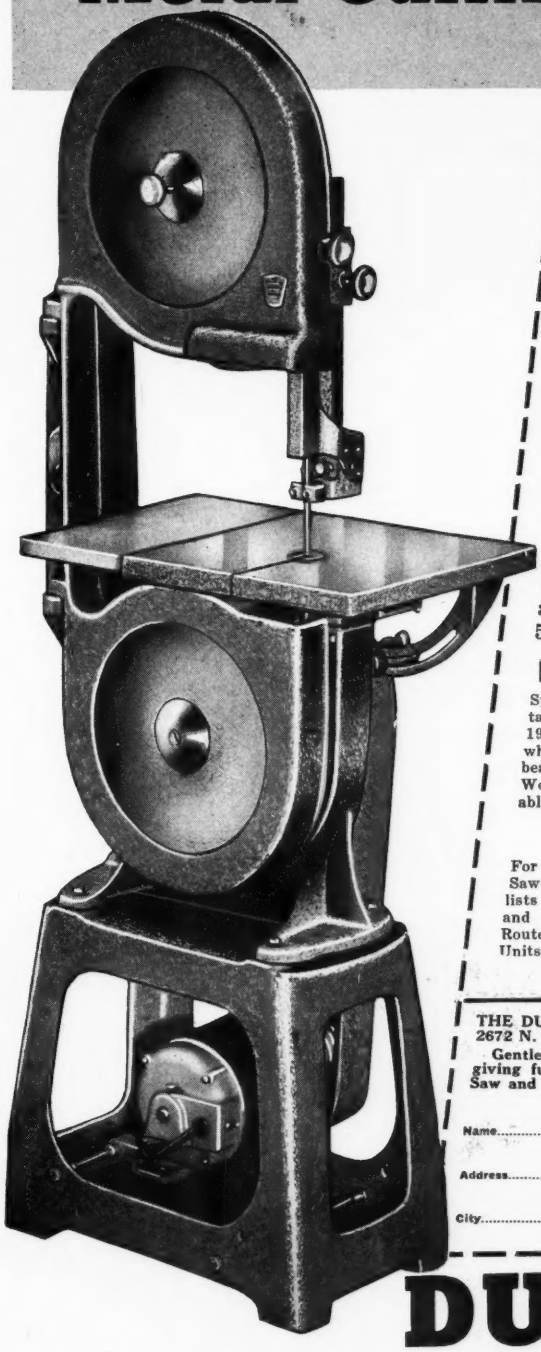

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Dakota, and part of Wisconsin for the purpose of finding out their local problems and then helping them work out satisfactory solutions. As one important solution he began to sell them on the idea of a paid training course at a central location. The successful program now operating is the result of these preliminary efforts plus the close cooperation displayed by the local vocational-school authorities.

Each dealer wishing to participate in the program recruits the new workers in his own community where the manpower "pinch" is often times less severe than in the larger cities. These workers are then put on the dealer's payroll ($25-$28 per week) and sent to St. Paul for their training. During this time the expenses are paid by the dealers. All of the trainees are housed and fed at one of the local hotels. For the four weeks of training, the room and board costs the dealer approximately $110.

The four weeks of concentrated training is carried on eight hours per day, six days per week. In addition, the men come back to the school five nights per week on their own time. The training is well organized and each day's instruction is worked out on a careful basis to provide for demonstrations, films, discussions, practical work, and oral and written tests. Extensive use is made of motion-picture films and other visual aids provided specifically for this course by the Chevrolet Motor Company. As is to be expected, the major emphasis is on the disassembly, assembly, and repair of actual parts. A progress chart enables the instructor to keep an accurate and close check as the worker performs the various operations. Each man has his own kit of tools which he takes with him on the job. The tools are paid for by the local dealer, but he is later reimbursed by the worker through deductions from his pay check.

At the end of four weeks the worker is competent to perform maintenance operations involving brakes, clutch, transmission, rear end, valve adjustment, and motor tune-up. It is not claimed that this program will turn out men who have the skill and judgment of experienced mechanics. However, the ability of many of these workers surprises even the "die-hards" among the dealers. Mr. John L. Burns, the zone manager and prime force behind the program, describes the effectiveness of the training with the following figures:

1. After four weeks of training the worker has the ability to produce approximately $2,000 worth of gross profit in a year's time. This does not take into account the additional training that will be received through actual experience on the job.
2. The investment on the part of the dealer is repaid in from six to eight weeks. This is significant and an important selling point for it shows that well-planned, organized training is not an added expense, but an investment which actually saves money for the employer over a long period.
3. A worker hired without previous experience would require one and one-half to two years to pick up the ability and knowledge that he gains in the four weeks of training. Instead of receiving haphazard instruction and advice by watching others work, the worker obtains organized, on-the-job instruction using the same tools and equipment that will be found in his dealer's shop.

The age of the students varies from 16 to 51 years with the average being slightly above 38 years. One or two veterans of the present war have been hired and placed and the program has been adapted in accordance with the training needs of these veterans. The school is flexible. Short courses can be added to give intensive training in specific operations whenever the need arises. It is expected that a continuing benefit of this particular program will be the upgrading or supplementary courses to be presented from time to time.

In generalizing on the two programs described herein and the other training activities in the field of automotive maintenance, several significant points stand out:

1. Local vocational schools can offer an instructional program entirely adequate to meet the training needs of the automotive maintenance industry.
2. Many shop owners are skeptical of the results produced by the schools and need to be sold on the idea of adequate organized training. One means of accomplishing this is to begin by offering supplementary courses for the workers already employed. If they get something from these courses you can be almost sure of their support for pre-employment training.
3. The post-war period offers many opportunities for the development of continuing training programs in the automotive maintenance field. This is a challenge to local vocational-school authorities.
4. Because the maintenance industry is made up primarily of small shop owners there is little chance that employers will be able to have individual training programs which are sufficient to meet the needs. This provides an additional challenge to the local vocational schools for they can well serve as the center of a cooperative training program serving all shop owners in the community.
5. Some notable progress has been made in the development of training programs for automotive maintenance, but there is still much that can be done both by the industry and by the training agencies before the ultimate benefits are realized.

Learning to cold weld cracked motor blocks at the Memphis, Tenn., Vocational School.

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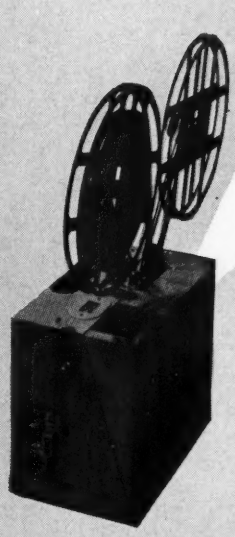

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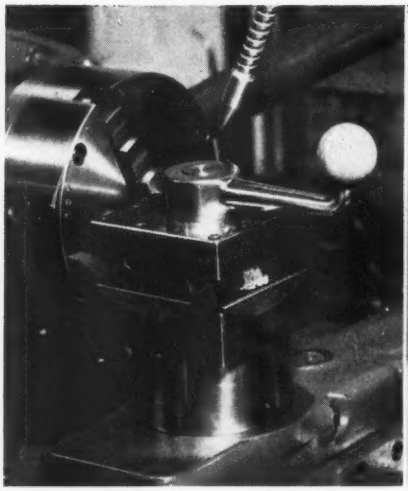
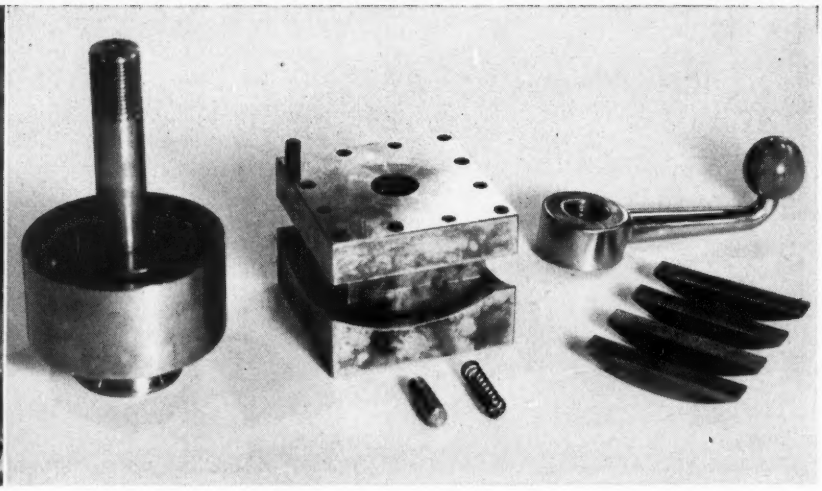




A Tool-Post Turret

BY *Jon P. Adams*
AND *M. B. Goodwin*

This Project-of-the-Month will enable the machine-shop instructor to teach a number of fundamental machine operations in the process of making a useful piece of equipment for the shop. The authors are preparing additional material of a similar high quality which will be published from time to time. J. P. Adams is in charge of the vocational machine shop of Proviso Township High School, Maywood, Ill., and M. P. Goodwin is in charge of machine drawing at Proviso Township High School and at the University College division evening school of Northwestern University, Chicago.

THE construction of the tool-post turret involves such machine operations as taper turning, surface grinding, cylindrical grinding to close limits, rotary table milling, and face cam milling. When completed it is a very useful piece of equipment for any machine shop.

The base of this turret was designed for the cross slide on a 10″ South Bend lathe, but may be readily altered to fit any lathe.

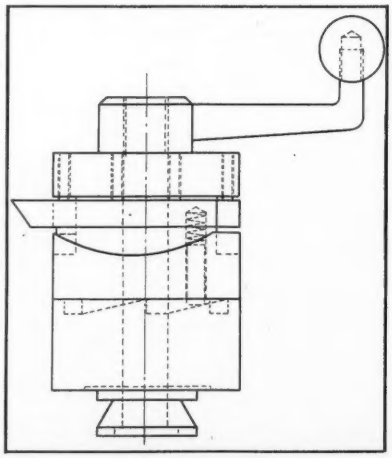
A variety of multiple tool set-ups can be made on any engine lathe with this turret.

The drawings are complete, so little will be said about machining the parts. However, a few suggestions may be in order. The square turret body is machined to size. A rotary table is used during the cutting of the 2½″ radius slots. The piece is clamped to an angle plate and the assembly set 2½″ off center one way and 3/16″ off center the other way. Note: the center of the 2½″ radius is not on the center line of the piece. The milling is done with a vertical head and an end mill.

The bottom of the square turret body which was left .010″ over size is surface ground after hardening.

The hole may be bored and reamed to size before hardening or may be left undersize and ground to .7507″ after heat treating. An internal grinder or a tool-post grinder may be used for the job.

The base of the piece offers no problem in machining except the spiral cam grooves in the top. These grooves form the stop positions for each of the four stations. They start flush with the top and run down ¼″ in one quarter of a revolution. Note: the spirals are right hand which causes the pin to be pushed against the stop as the locking lever is tightened. The spiral grooves are machined with an end mill in a vertical head. The piece is held on a rotary table or a dividing head. If a dividing head is used, the piece is pressed on a mandrel and chucked in a vertical position.



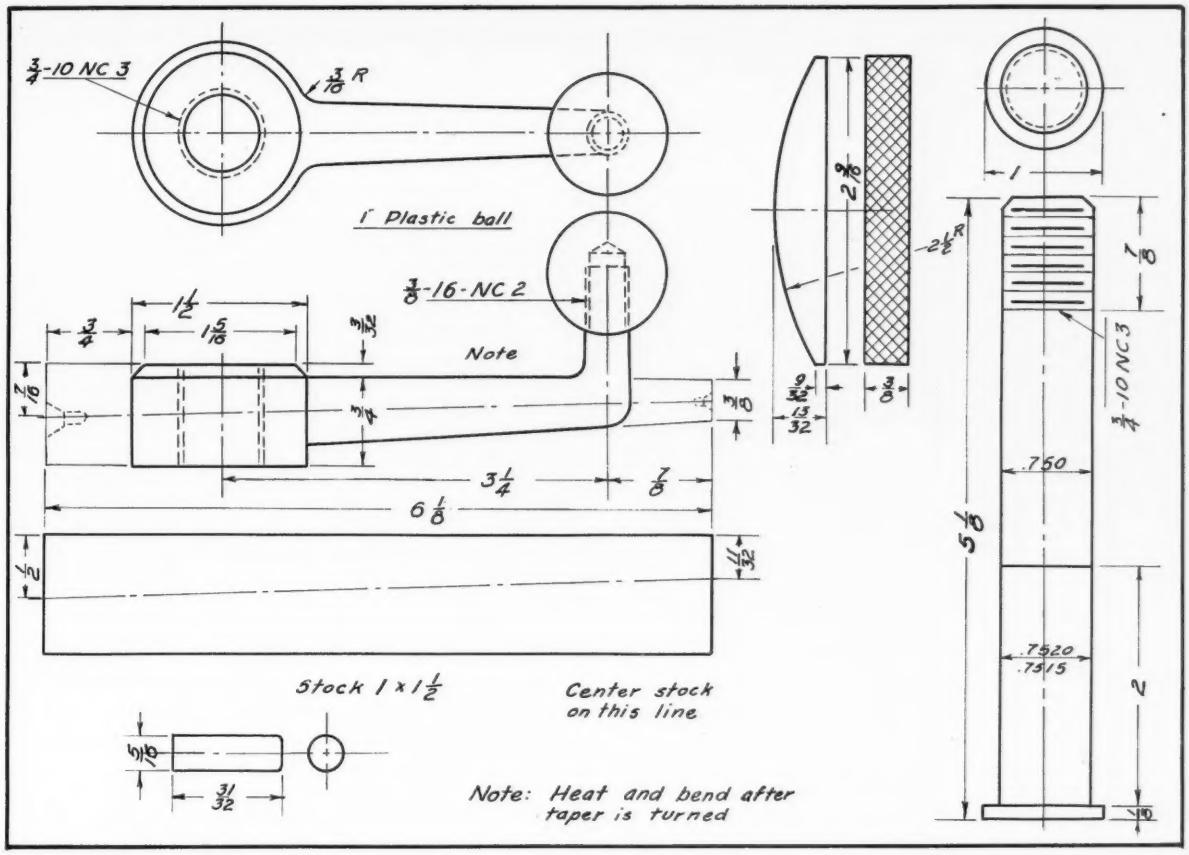
Milling the spiral is a simple problem in indexing. The depth is ¼″ or .250″. Therefore, divide the entire circle into 1000 parts. Next, use the formula $\frac{40}{N} = \frac{40}{1000} = \frac{1}{25}$ or one division on the 25-hole circle. For each .001 the end mill is fed down the head is rotated one division on the 25-hole circle. This is continued until a depth of .250″ is reached. At that time 250 divisions on the dividing head or one quarter of a turn of the piece will have been completed. The result will be the required spiral made in a series of minute steps, each .001″ long and .001″ deep. The steps are easily smoothed down by hand or with a hand grinder. The operation is repeated four times in order to finish the four steps.

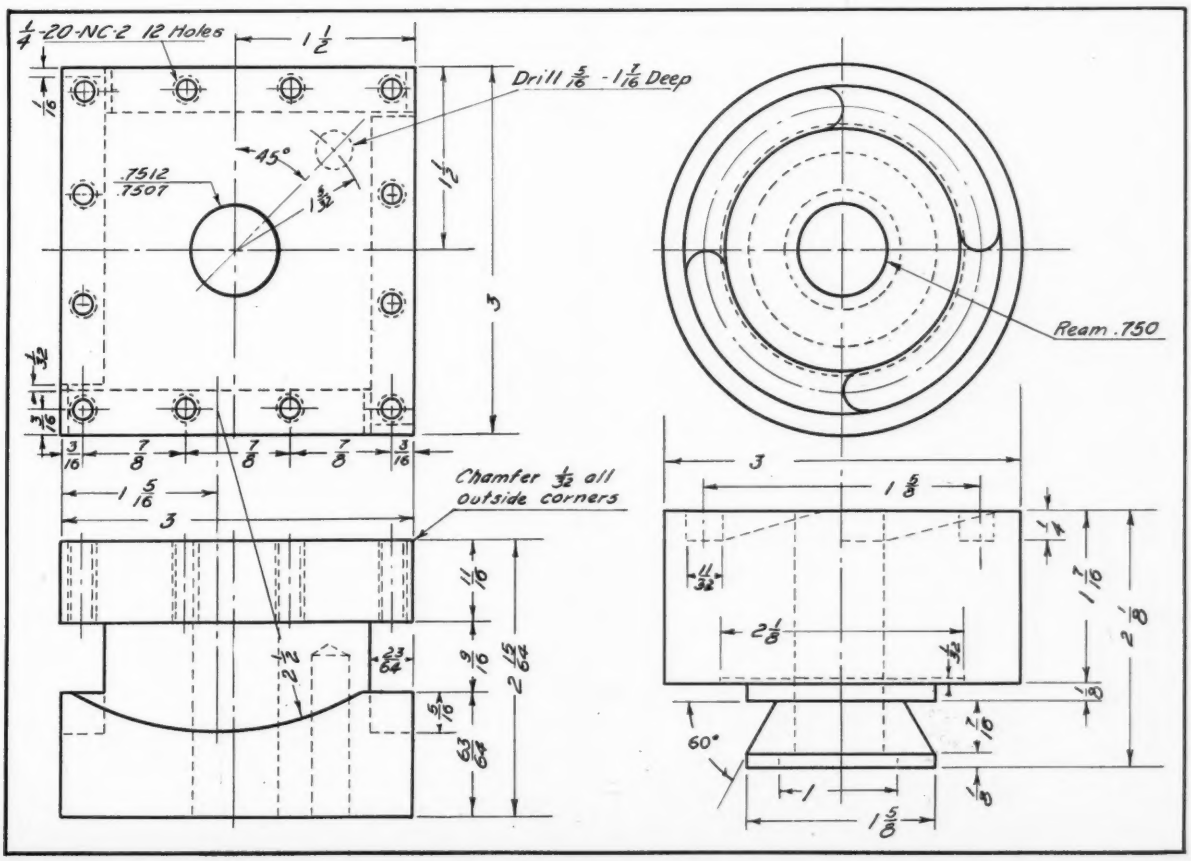
The 5⅛″ pin is preferably turned, heat treated, and ground to size on the cylindrical grinder. If it cannot be ground, it may be turned to size and not hardened. This pin is a press fit in the base and a running fit in the block.

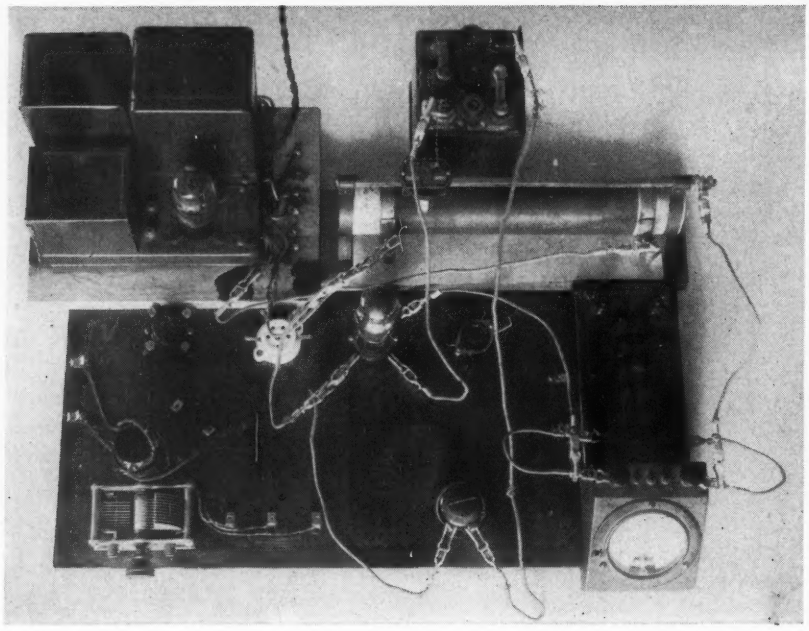
The locking lever is turned off center as indicated in the drawing. The Do-All contour machine may be used to form the head of the locking lever. If the 1″ ball is made of red plastic, the professional appearance lacking in many school projects is gained.

The rockers can be cut and filed to shape on the Do-All or they may be milled or shaped. The rockers must be serrated on the top to prevent the tool from slipping. This job may be done on the shaper or mill. Finally, they must be heat treated.

The authors of this article have found the tool-post turret project an excellent teaching device and it is a practical tool as well. Comments on this article will be appreciated.


3/4-10 NC 3
3/16 R
1" Plastic ball
3/8-16-NC 2
Note
Stock 1 x 1 1/2
Center stock on this line
Note: Heat and bend after taper is turned
.750
.7520
.7515


1/4-20-NC 2 12 Holes
Drill 5/16 - 1 7/16 Deep
45°
.7512
.7507
Chamfer 1/32 all outside corners
Ream .750
60°



Left—Workboard showing layout for determining the plate characteristics of an O1A radio tube. Note use of jumper clips.

Radio Instruction in the High School

BY *Helge E. Hansen*

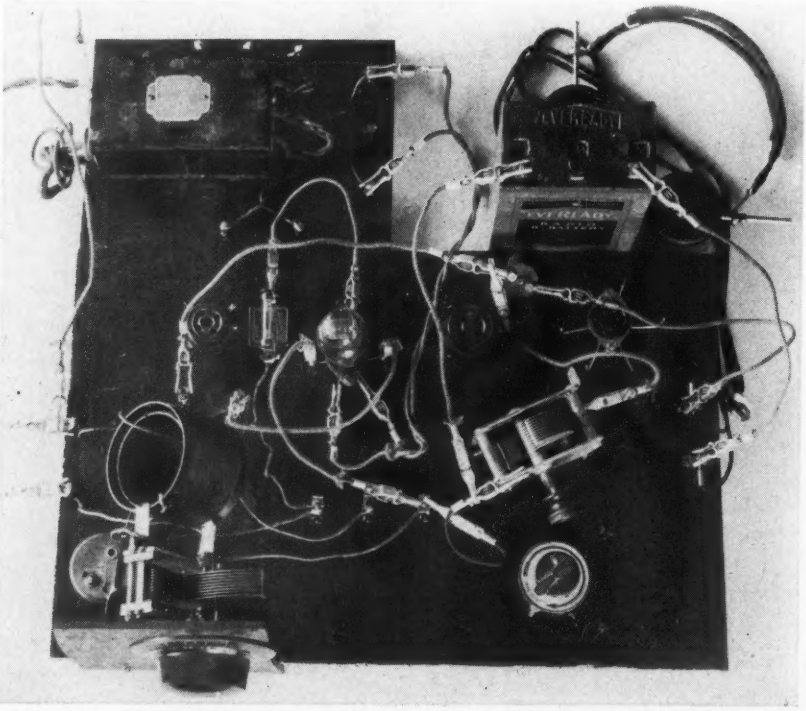
Teachers of preinduction courses in radio will find the practical ideas in this article of great interest. The author teaches radio in the Ann Arbor, Michigan, High School, has had industrial experience in the field of electronics, and has earned a master of science degree in electrical engineering, spcializing in radio.

WITH the present emphasis on preinduction courses, radio has attained its rightful place in the school curriculum as another worthy course. The majority of pupils entering courses in electronics cannot be expected to do much of the difficult mathematics of radio or perhaps to completely understand many of its basic principles. Nevertheless, with suitable equipment many of the fundamental ideas can be mastered.

The material for this article was derived from teaching a high-school course which meets five times per week with an average class period of 48 minutes per day. Also some of the ideas have been tried on adult classes in night school with excellent results. In both these courses, time has been of major consideration because it was felt that neither theory nor laboratory work could be neglected. Demonstrations are of only minor value in radio—you must set up the circuit to understand it.

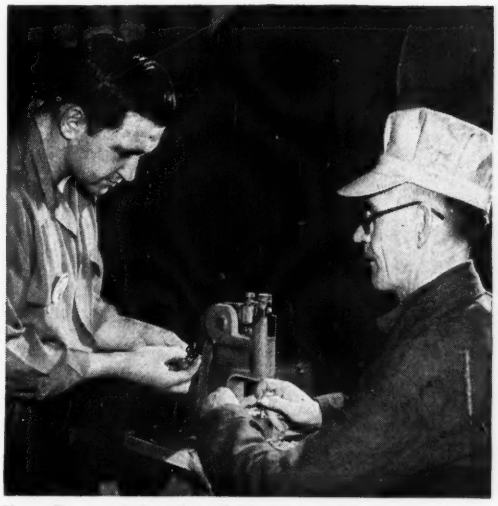
We met the time factor in two ways. First we obtained alligator clips which are cheap and easily obtained and made enough jumpers for several sets. These jumper leads should be in all lengths from about 3″ to 5′ and made of flexible wire. We then designed a work board 14″ by 18″ as shown in Figure 1. Most of the circuits to be constructed can be made using this board. We found that one 6-prong, one 5-prong, and two 4-prong sockets allowed us to use most of our salvaged equipment. Then, by taking apart old sets and combining the various coils and tuning condensers, we set up tank circuits. The coils were tapped as shown for short-wave and oscillator work. Because Fahnestock clips are cheap, all leads were terminated in these. Our alligator-clip jumpers then could furnish the remainder of the connections. We also included a rheostat for DC work such as test runs on O1A tubes which are rugged enough for beginners to use.

For batteries we have been using salvaged storage batteries. By visiting local battery shops we found many batteries which would hold a charge for a week at a time, but were no longer of value for automobiles. We bought some at salvage prices and were given others. When these gave out, we simply exchanged them for some in a better condition. The procedure was very economical. For higher B voltages, power packs from old sets were rigged up with bleeder resistors which allowed us quite a range in voltage up to 250 volts. The filament leads were also brought out and appropriately marked.



Left—Workboard layout for the condenser controlled regenerative detector circuit.

MT. CARMEL WHERE ELECTRONICS IS KING



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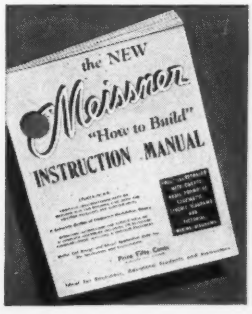

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Perhaps the greatest difficulty encountered was the lack of headphones and meters. Fortunately, most physics departments have DC voltmeters (0-15, 150 volts), ammeters (0-1, 10 amp.), and galvanometers. However, most of our work requires milliammeters which are hard to get, so we decided to convert the galvanometers into sensitive milliammeters. The problem becomes one of preparing shunts of such size that various ranges could be used. On some standard Weston galvanometers, a shunt of 1:13 will give approximately full-scale deflection equivalent to one milliampere. Other higher ranges may be obtained in a similar manner using still larger shunts.

It should also be remembered that these same galvanometers make excellent voltmeters. For direct reading on a 0-to-50 scale, 650,000 ohms (more or less, to be checked with a good meter) are required.

Headphones were obtained by an advertisement in the local newspaper. Of course these had to be purchased, which has been one of our largest outlays. Each group of pupils should have at least one or two headsets to make the work interesting.

Most of the circuits included here are for 2½-volt tubes because so many salvaged power packs have this tap available and also because the 27 tube is quite easily obtainable.

A 24A tube may be substituted in most of the circuits with a few minor changes. All construction has been considered from the viewpoint of using salvaged equipment.

To construct these circuits just for the experience may have value, but grid condensers and grid leaks should be varied and plate loading resistors and coupling condensers should be studied so the pupil gets experience using parts of the right size. He should then recall his theory with regard to why the particular size works best. The student should also be told about the working voltages of condensers. All values given in these diagrams are average values for resistors and condensers. The pupil is *expected to experiment* and to write up his results.

It has been emphasized before that time is a major consideration. A teacher of radio must teach mathematics and physics along with his electricity and radio. High-school classes in radio are usually a single period in length. Hence, laboratory work may extend over two or three periods. It must come when there is a psychological need for it. The pupil should not need more than 15 to 30 minutes to complete any circuit using alligator clips on jumpers. This will allow him plenty of time to make adjustments or to rewire if it does not work. Groups may combine their workboards with others who have built R.F. or A.F. amplifiers to get multi-tube sets.

We feel that a pupil on completing a course in radio should have constructed several types of receivers (broadcast and shortwave), run characteristic curves on both triodes and pentodes, constructed oscillators both RF and AF, set up a power pack, used a vacuum-tube voltmeter, and built a small transmitter. At least 25 separate circuits are constructed by all members of a class. In the meantime he will have completed a beginners' text on the fundamentals of radio and have repaired a receiver which is faulty.

Fig. 1—Utility board layout plan.

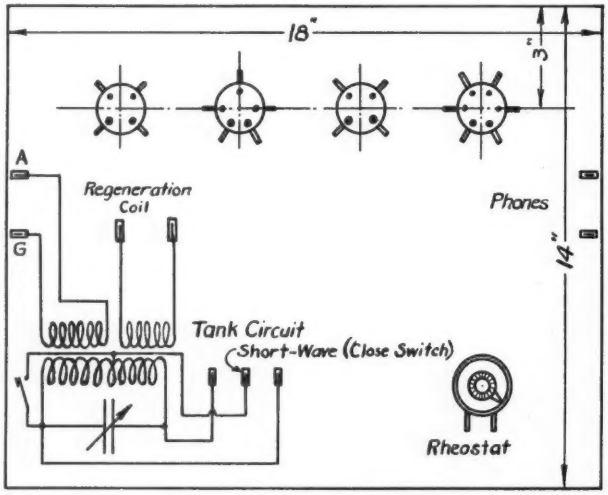


Fig. 2—Filament emission curves—resistance vs. temperature.

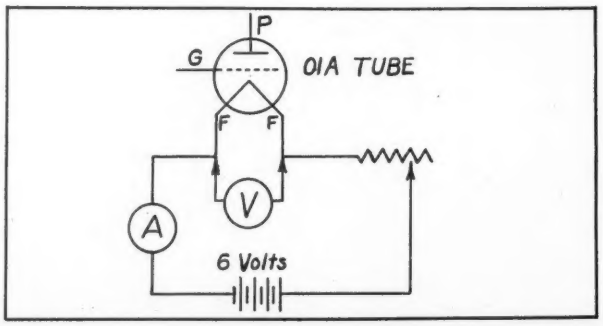


Fig. 3—Filament emission curves.

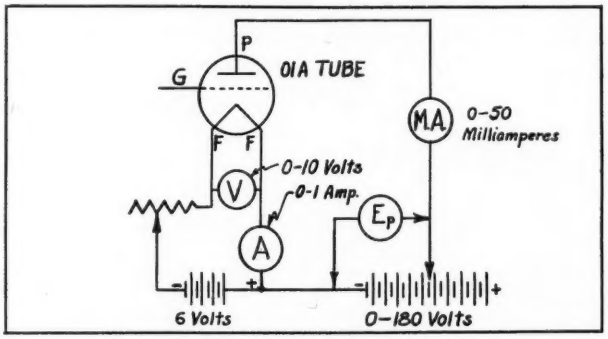


Fig. 4—Plate characteristic curves.

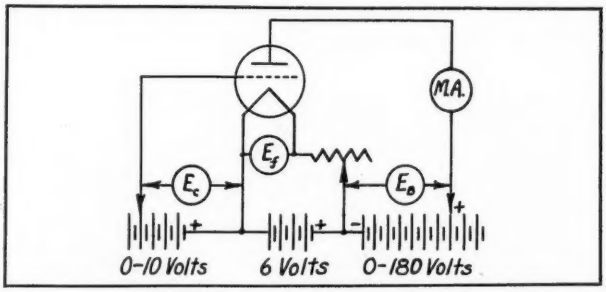
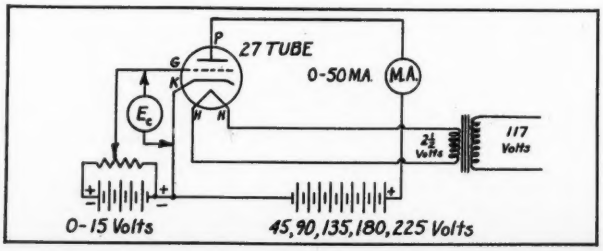


Fig. 5—Grid characteristic curves.



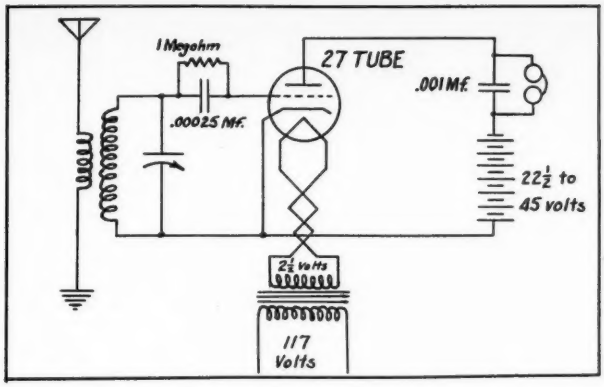


Fig. 6—Simple grid detector.

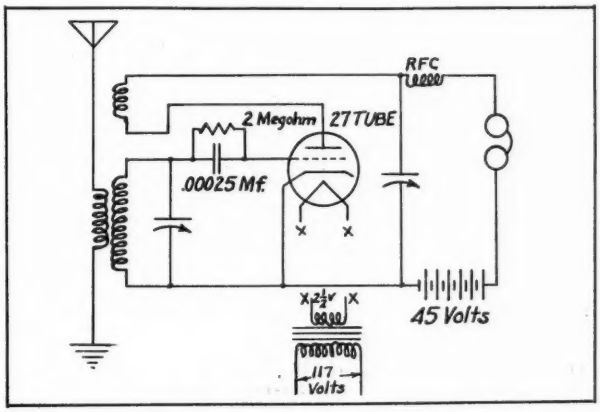


Fig. 7—Regenerative detector—condenser controlled circuit.

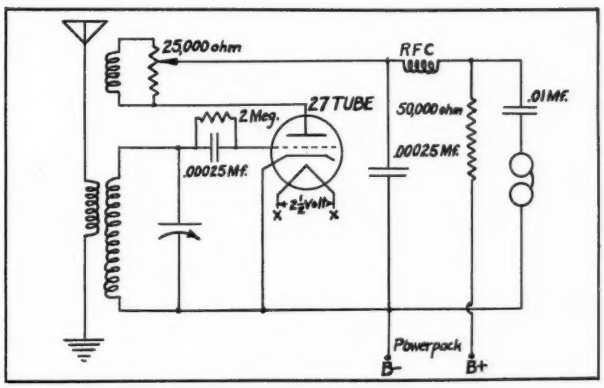


Fig. 8—Regenerative detector—resistance controlled circuit.

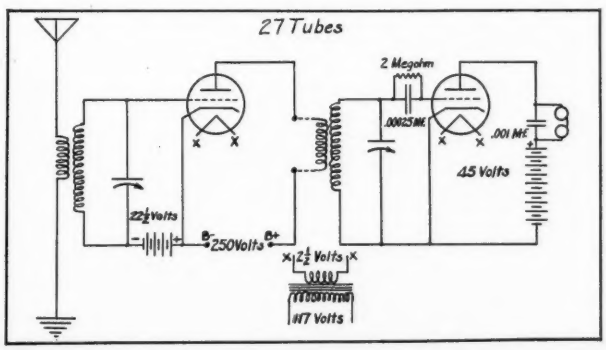


Fig. 9—Simple R. F. amplifier and detector.

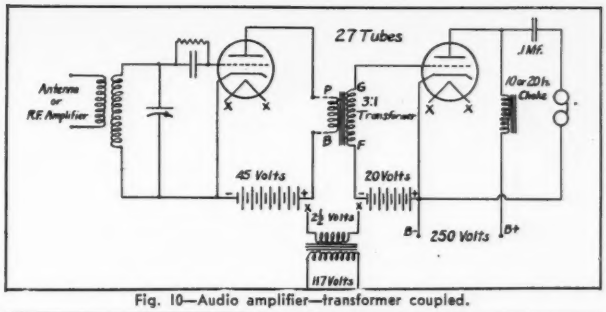


Fig. 10—Audio amplifier—transformer coupled.

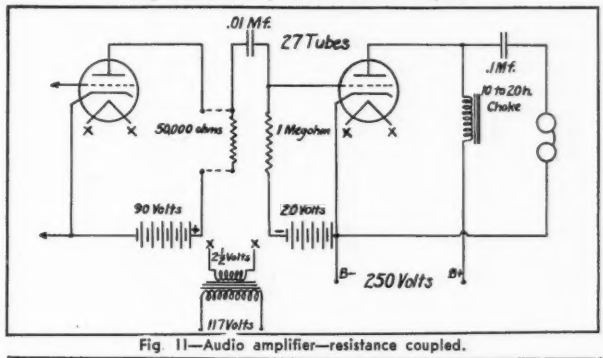


Fig. 11—Audio amplifier—resistance coupled.

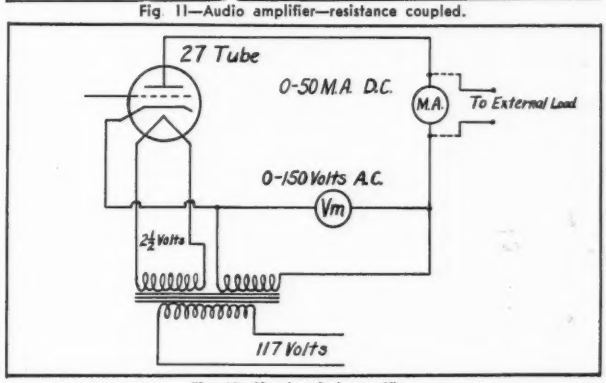


Fig. 12—Simple triode rectifier.

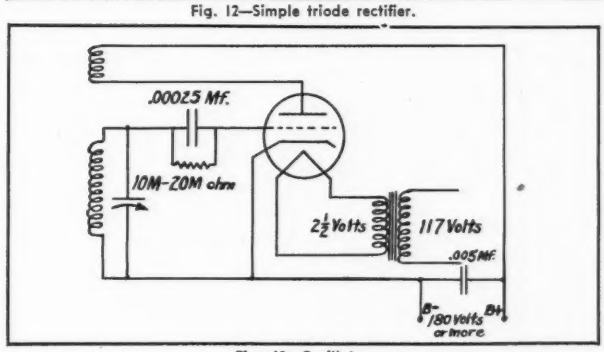


Fig. 13—Oscillator.

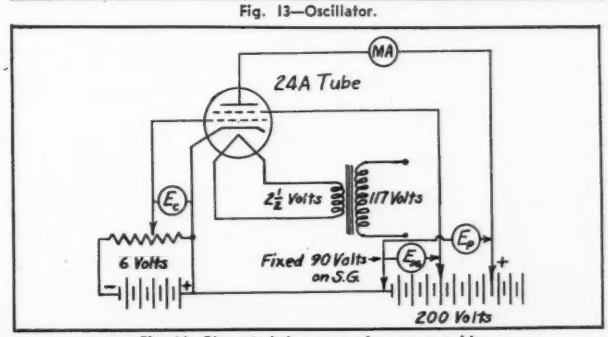


Fig. 14—Characteristic curves of a screen grid.

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A catalog profusely illustrated with actual operating photographs showing many applications of the "Di-Acro" system of die-less duplicating, originated by O'Neil-Irwin from specially designed benders, brakes, and shears employed individually and in coordination for accurately and economically producing duplicated parts with out die delay or expense. For complete details and catalog, circle 33.

34 Black-and-White and Blue Printing Equipment Bulletins. Peck & Harvey, 4326 W. Addison St., Chicago 41, Ill.

Comprehensive, well-illustrated bulletins that fully describe the Peck & Harvey line of black-and-white and blue printers. Gives the capacities, performance speeds, and features of the sheet and continuous operation printers, dryers, and developers. Explains how **easy** and **economical** it is to make your own blueprints or direct process black-and-white prints. (Advertisement on page 27.) Full details free if you check the coupon.

35 Streamlined Hand Tools. Plomb Tool Co., 2209 Santa Fe Ave., Los Angeles, Calif.

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special midget tools, and radio tools are only a few of the many types listed. Complete specifications given. **Check the coupon below.**

36 Metal Cutting Saws. Racine Tool & Machine Co., Dept. SS, Racine, Wis.

Descriptive bulletin on hydraulically operated **Metal Cutting Saws.** Belt and motor driven machines designed for all classes of metal-cutting work. Circle the number for your **free** copy.

37 Shop, Industrial, Aeronautics Texts. The Ronald Press Co., 15 East 26th St., New York 10, N.Y.

Latest Ronald Press books for vocational training include **Shop Mathematics, Chemistry and the Aeroplane, Basic Radio,** and **Aerodynamics and the Aeroplane.** Previously published texts are **Blueprint Reading, Weather Study, Modern Trigonometry, Science Training for Metal and Wood Working,** and many others. For complete information just check the coupon below.

38 Glider Construction. Sailplane Corporation of America, 9470 Santa Monica Blvd., Beverly Hills, California.

Construction Manual (194 pp., 69 job sheets, 85 production photographs, and 124 drawings) and **ten detailed master drawings** (each line numbered for cross reference) now available on **free examination basis.** Inexpensive to build, uses available materials, teaches all basic wood-aircraft and glider construction technics. Just check the coupon.

39 How to Build Scale-Model War Planes. X-acto Crescent Products Co., Inc., 440 Fourth Ave., New York 16, N.Y.

Second edition of this beginners' booklet on how to build scale-model war planes required by the Army and Navy for spotting, identification, range finding, etc. Templates, assemblies, procedure chart. Free to teachers requesting it on school stationery.

For brochure on X-acto knives check coupon.

40 Shop Bench Catalog. E. H. Sheldon & Co., 728 Nims St., Muskegon, Mich.

Special shop bench catalog, covering all types of benches from woodworking to parachute folding ones, enables the instructor to plan benches of any desired length and width by selecting standard tops, legs, and cabinets. No charge—just check the number below.

41 Precision Lathes. Sheldon Machine Co., Inc., 4240 N. Knox Ave., Chicago, Ill.

Sheldon's latest catalog of precision lathes, arbor presses, machine vises, and angle plates. Descriptions and pictures of various lathes. Complete specifications and price lists.

42 Shop Mathematics at Work. Blueprint Reading at Work. Silver Burdett Co., 45 East 17th St., New York 3, N. Y.

Simple, accurate, and easy to use workbooks which provide just the **kind** and **amount** of training in two fundamental shop skills required by industry itself. Written by experienced teachers with the cooperation of men in industry, and will do the job **you** want done—**fast!** For complete information just circle the number below.

43 Special Tool Maintenance Manual and Catalog. Skilsaw, Inc., 5029-A Elston Ave., Chicago 30, Ill.

Contains an informative well-illustrated section on "How to Get the Most from Your Portable Electric Tools." Full of valuable hints and suggestions on the care and operation of electric tools. Also contains a complete up-to-date cataloging of Skilsaw Portable Electric Tools. **Free** to shop teachers—just **check coupon.**

44 Practical Training Helps. South Bend Lathe Works, South Bend 22, Ind.

Two motion pictures in sound and color on lathe operation available on a free-loan basis. Write for **circular 8-A.** Free sample copies of books, pamphlets, and other material on lathe operation and care are offered to shop instructors in **circular 21-C.** For **catalog 100-C** describing the entire line of South Bend engine, toolroom, and turret lathes **check the coupon.**

45 Router-Shaper Catalog. Stanley Electric Tools, Educational Dept., New Britain, Conn.

Catalog 606 lists **Stanley Router-Shaper** tools and accessories and describes woodworking operations that can be accomplished with these tools. **Catalog 67** describes portable electric tools for wood- and metalworking shops. Both catalogs **free to teachers.**

46 Tool Catalog. Stanley Tools, Educational Dept., New Britain, Conn.

Catalog 34 shows tools for woodworking, farm, electrical, sheetmetal, automobile, machine, and forge shops. **Free on request.** Also **Stanley** wall cards, notebook pages, and other visual teaching aids available at cost.

47 Amateur Radio, a Beginner's Guide. Thordarson Electric Mfg. Co., 500 West Huron St., Chicago, Ill.

Recognized and endorsed by radio experts and teachers, this practical book covers everything, from learning the code to the actual building of a transmitter. Check the coupon and **enclose 75c.**

48 Directory of 16mm Film Sources. Victor Animatograph Corp., Davenport, Iowa.

Eighth revised edition of this handy 148-page booklet listing sources of 16mm films available on a rental, purchase, or free-loan basis. **Subject-source index** makes it easy to find films on various subjects. **Bibliography on visual aids. Only 50c.** Check number and enclose money.

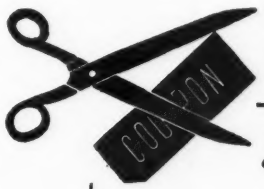
49 Wiley Books 1943-1944. John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.

Latest catalog of complete line of Wiley books on aeronautics, drawing, engineering, industrial processes, mechanics and materials, etc. List of new books in press includes Fundamental Radio Experiments, Elementary Aircraft Mechanics and Alternating-Current Circuits.

50 "How and Why" Data Sheets. J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N.Y.

A—Valuable "know-how" information on turning, boring, cutting-off, knurling, etc., as well as the use of lathe dogs, "C" clamps, eye bolts, and wrenches is given on these **data sheets,** which are punched for three-ring binders. Available at no cost in reasonable quantities for individual distribution to students; indicate the number desired.

B—"How to Select and Use Wrenches" is an interesting educational booklet available to teachers free of charge.



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Detroit Teaches

BY *Walter J. Larson*

THE rapid expansion of the aircraft industry in the Detroit area was primarily responsible for the Detroit Board of Education's action in establishing the Aero Mechanics Vocational High School.

The first classes were placed in operation on September 7 and at present the school has a capacity enrolment of approximately 200 boys.

The primary objective of the school is to qualify as many students as possible for the aircraft and engine certificate granted by the Civil Aeronautics Administration. In addition to qualifying for the "A" and "E" certificate, it will be possible for a pupil who satisfactorily completes the four-year course to receive a high-school diploma.

The courses are at present set up so that a student spends three hours per day in the shop and three hours a day in related or academic subjects. The shop work consists of preparatory courses in bench work, riveting, machine shop, welding, and mechanical drawing. These courses are given as a basic background for the aircraft engine and the aircraft construction courses.

The academic subjects offered consist of English, mathematics, social science, and physics. The text materials used in the English courses are chosen with a view toward stimulating an interest in the various phases of aeronautics. The students are enabled to build up a vocabulary of aircraft terms and to use them correctly in sentence structure and theme writing. Class discussion and reading involve material and part specifications, civil air regulations, and current literature on all phases of aircraft operation and maintenance.

The mathematics courses include a review of arithmetic and proceed through algebra and trigonometry. The problems given are similar to those that an individual is likely to encounter in any phase of the aircraft field.

In the physics courses the students are taught the fundamental principles of aerodynamics, heat, hydraulics, basic electricity and magnetism, strength of materials, and mechanics.

In the social-science courses the students learn something of the development of the aircraft industry and its effect on the economic and social structure of our nation. An attempt is made to portray coming events in the new air-age and to delve into the changed relationships among the peoples of the world that will most assuredly follow as a result of heavy airborne passenger traffic and s h r i n k i n g international boundary lines.

Enough mechanical drawing is given each individual to enable him to understand thoroughly the aircraft prints which he will need to interpret. They are made conversant with standard aircraft practices, specifications, and symbols.

In the shop courses the students tear down and assemble various types of aircraft engines. They are taught to time valves, magnetos, and do trouble shooting.

The school is equipped with test stands where the engines may be run in after major overhaul, or engine testing may be taught.

In the aircraft construction classes the students become conversant with the control and structural members of various makes of ships. They are taught to fabricate new parts or repair any damaged or broken member in accordance with the Civil Aeronautics Manual. The aircraft construction courses involve a

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Aero Mechanics

Vocational schools are paying increasing attention to the preparation of students to pass the Civil Aeronautics Administration examinations for aircraft engine and aircraft mechanics' certificates. This article tells about Detroit's arrangements to meet this need. The author is a counselor in the Aero Mechanics Vocational High School.

number of skills such as drilling, riveting, welding, metal forming, wood working, sewing, doping, cable splicing, and aircraft rigging and assembly.

The Aero Mechanics School is one of the few public high schools in the United States that has been certified by the Civil Aeronautics Authority as a licensed repair station for certificated aircraft. The school is ideally situated on the edge of the city airport and ships can be flown in and wheeled into the school's hangar. The students have an opportunity to work on certificated aircraft, engines, and instruments. Any ship that has had major repair or overhaul is test hopped by a qualified instructor at the school to check the ship for performance.

Any student who is admitted to the school must demonstrate an interest in aircraft work. He must be a graduate of the eighth grade and a minimum age of 14 years and 3 months. All students are given an aptitude test before final acceptance into the school.

The Aero Mechanics Vocational High School places instructional emphasis on the repair of aircraft and engines. The students enrolled learn that there is a great deal of hard manual work connected with the business of flying. The school is in no sense of the word a "flight school," but the work offered is a splendid basic foundation if a student hopes to fly at a later date.

Mr. George Tabraham is the director of the school and is well qualified to act in this capacity. He received his first flying lesson in France during the First World War where he served with an engineering detachment. He has trained many of Detroit's fliers, was the first distributor of commercial aircraft in Michigan, and has some 3,500 hours in the air.

He was formerly head of High-School Aeronautical Vocational Education in Detroit. The faculty of the school at present consists of a certificated teacher of aircraft engines, a certificated aircraft construction teacher, and five other teachers who conduct related and other vocational shop courses.

As soon as contemplated alterations are made to the present building in which the school is housed, it will be possible to expand the number of vocational subjects offered and to take in more students. There is at present a waiting list of students for the February enrolment.

Dr. Warren E. Bow, Superintendent of Schools, and Mr. Earl L. Bedell, Divisional Director of Vocational Education, have indicated that it is their hope that the school will offer to Detroit's airminded youngsters an opportunity to acquire the skills and inspiration that will enable them to take their place in Detroit's expanding aircraft industries. With the opportunity offered at the Aero Mechanics School there is every reason to believe that many young men in the Detroit area will find the inspiration to spur them on to become leaders in the field of aeronautics.

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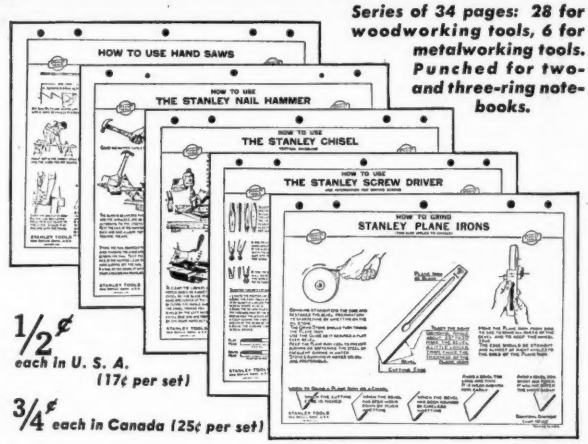
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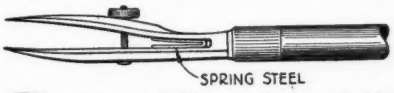
BY *Wallace I. Victoria*

Chairman, Mechanical Drawing Department, Queens Vocational High School, New York City



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ABOUT YOUR FELLOW TEACHERS

GEORGE P. HAMBRECHT, State Director of Vocational and Adult Education for Wisconsin, passed away on December 23, 1943, following a heart attack. He was 72 years old and had been state director for 22 years. . . . EDGAR J. SPADY, Director of Industrial Education, Richmond, Ind., has become Director of War Training and General Coordinator of Vocational Education for Oklahoma City, Okla. . . . FRANK P. JOHNSTON, Supervisor, Bureau of Industrial and Technical Education, New York State Education Department, has succeeded OAKLEY FURNEY as chief of the bureau. Mr. Furney has become Assistant Commissioner for Vocational Education in the state department. . . . ED MELIN, Supervisor of War Training for the Michigan Board in Control of Vocational Education, has been appointed city director for Traverse City, Mich. . . . LEWIS HODGES, president of the Michigan Industrial Education Society and teacher at Grand Haven, Mich., has been commissioned a lieutenant (j.g.) in the Navy. . . . ELMER S. PIERCE, principal of the Seneca Vocational School, Buffalo, N. Y., retired last summer after 34 years in the position. . . . LORENZ C. SCHELHAS, former industrial arts instructor at Hastings, Mich., has been appointed a member of the engineering drawing faculty of Notre Dame University, South Bend. . . . GILES M. RUCH, Chief of the Research and Statistical Service, Vocational Division, U. S. Office of Education, died by his own hand on November 15.

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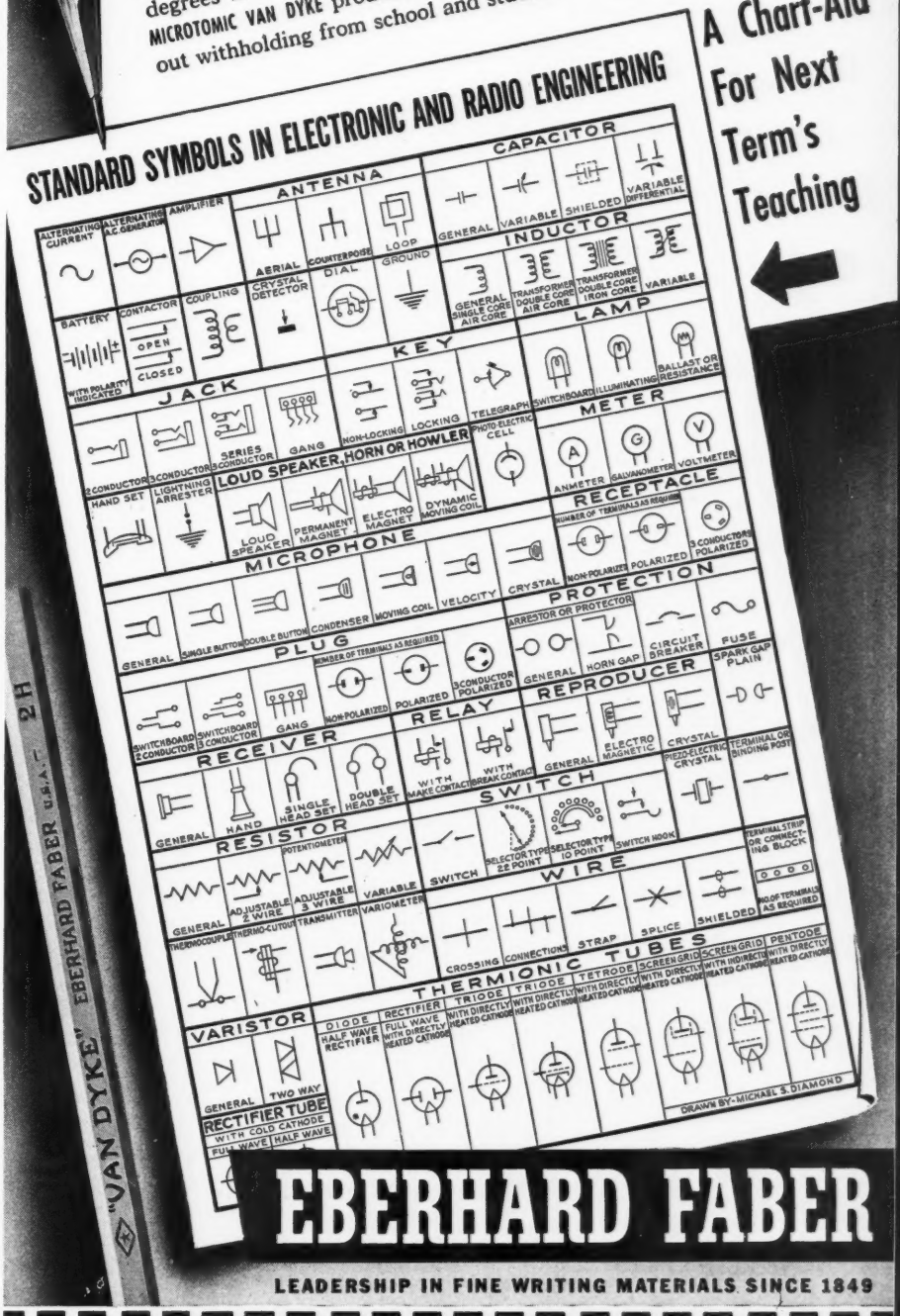

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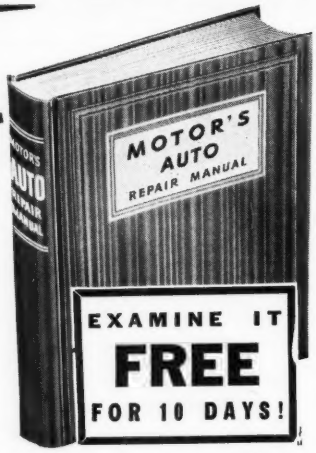

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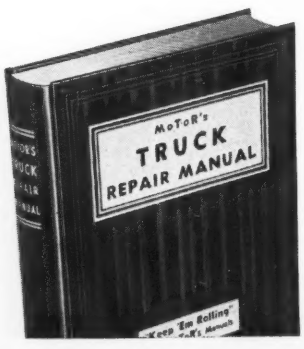

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IN THE Morning Mail . .

[Brief comments about SCHOOL SHOP and the field it serves are invited. Address the Editor, SCHOOL SHOP, Ann Arbor, Michigan.

Gentlemen:

My attention was particularly attracted to Michael Paca's editorial "*From Washington,*" on page 32 of your October 1943, issue, and his discussion of the "four steps," and of the relative merits of single skills and broad background.

There are several things which I should like to say on this subject, if in your opinion they would be of interest to your readers. Briefly, there should be no real conflict between the two. I, for my part, am a strong advocate of both. The apparent conflict between them seems to me to be a failure on the part of proponents of both to fully comprehend the scientific principles involved in the art of teaching. Fundamentally those scientific principles are the same, regardless of the type of learner or the nature of teaching content.

The "four steps" which are described as so popular at the present time are but one of the many adaptations of the so-called Herbartian analysis. Their present popularity, despite their incompleteness, is in my opinion due to the fact that the retainers of the broad background idea have completely neglected them, while the intensely practical worker, who has a specific job to do and who does it well, receives well deserved recognition.

We may cite if we wish the old parable of the mushroom and the oak tree, but in so doing we should not forget that both are useful, and that neither can be substituted for the other.

NEWTON VAN DALSEM,
Los Angeles, California.

Gentlemen:

I wish to express my thanks for your magazine which I have been receiving regularly. It has had many good ideas.

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Are They Harmful? *(from page 26)*
paper enables the student to center his work.

It is my contention that the conventional use of projection lines is a necessity. Most good textbooks advocate their use. I feel that more attention should be given to the weight and sharpness of lines, proper dimensioning and indication, good lettering, and cleanliness.

There are, of course, dull students in any class who have been and always will be confused or baffled by any method, old or new, regardless of how simple it may be. Even the use of full-size models of mechanical objects fails to help them progress. We must bear with them, however, and give them more individual attention and encouragement.

From Washington *(from page 32)*
meet unexpected opposition from Hitler's guns, we shall have to set new production quotas to assure an overwhelming supply of arms. In that case, industrial arts equipment will be restricted once again.

● "Tell the nation's shop teachers that my bill providing educational opportunities for veterans has been altered to eliminate any possible suggestion of federal control of education," Senator Elbert Thomas of Utah told this reporter.

Thus, some of the criticism directed against S. 1509, especially by vocational educators, has taken effect. In its original form, the measure provided no safeguards against the long arm of Uncle Sam, and protests were heard from AVA headquarters in Washington, its convention in Chicago last month, as well as from state officials. Immediately after New Year's Day, a Senate subcommittee began to revise the bill and soon thereafter came the Senator's statement.

● Making the rounds of Washington high spots for news, your reporter heard:

At the U. S. Office of Education: "Might tell the nation's shop teachers to tune in their radios February 18. Fred Waring's 'Pleasure Time' program will pay coast-to-coast tribute to vocational educators for their great work for the war effort." (Time: 7 P.M. EWT, NBC.)

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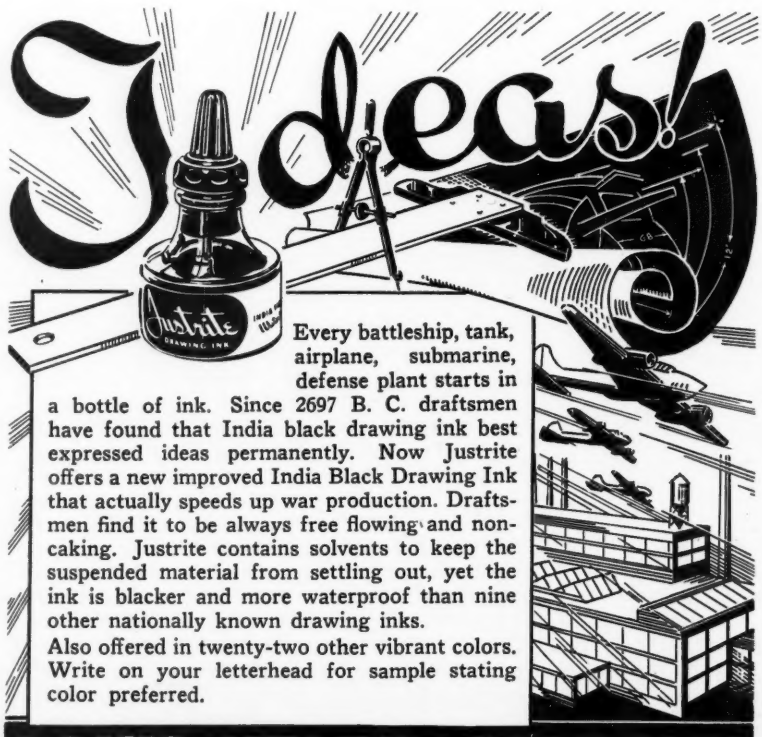
news
WHAT'S DOING IN THE FIELD OF INDUSTRIAL EDUCATION

INFORMATION received by the U. S. Office of Education indicates that public vocational schools in approximately 100 cities are conducting short, intensive courses under the program of Vocational Training for War Production Workers for men and women recruited for jobs in the motor transportation industry. [See article on pages 3-6 of this issue.—*Editor.*] According to the Office of Defense Transportation estimates, employment needs, including expansion and replacement needs, of motor transportation lines are approximately as follows:

361,000 workers for trucking lines.
27,000 workers for intercity bus lines.
70,000 workers for local motor transport lines.

The ODT has sponsored a preventive maintenance program of present motor transport equipment. The success of this plan, to a large degree, depends on the number of trained personnel, both men and women. Schools in 32 states are already carrying on the program. VARIOUS state educational groups in Michigan have combined forces under the banner of the Michigan Vocational Association. Representatives of the Michigan Industrial Education Society, the Michigan Association of Teachers of Vocational Agriculture, the Michigan Home Economics Association, and of business and distributive education met in December to effect the organization. Some of the organizations will hold separate conventions and meetings but the first convention of the new organization is slated for Grand Rapids on April 20-22. Lynn Heatley is president.

SLIDEFILM projectors are now available for purchase by schools for preinduction and vocational training. The procedure is as follows: (1) Complete three copies of Form WPB-1319 and submit the original and one copy to the War Production Board, Consumers Durable Goods Division, Washington 25, D.C., Reference L-267. (2) One copy will be returned and is your approval to purchase and should accompany the order for the projector. Copies of the form may be secured from the WPB at the aforementioned address.



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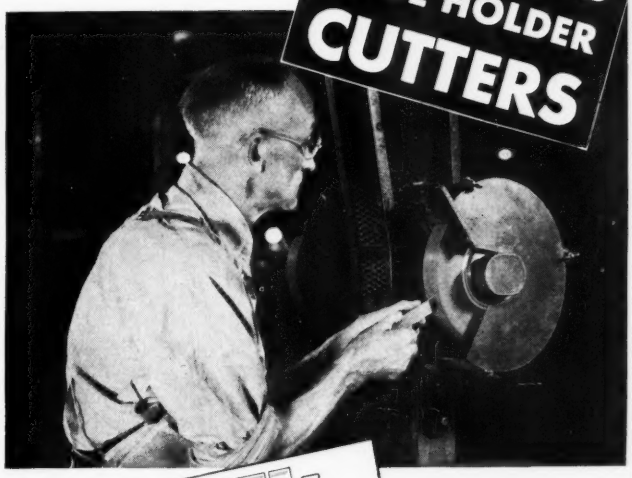

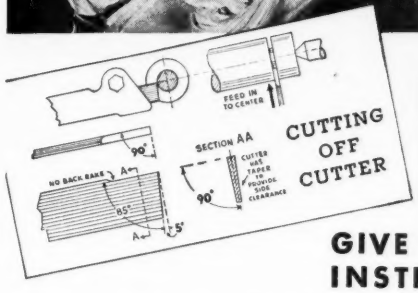

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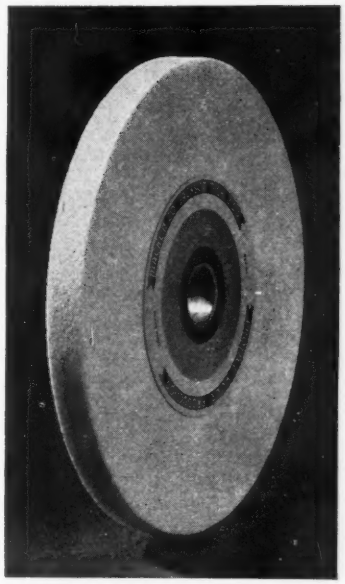

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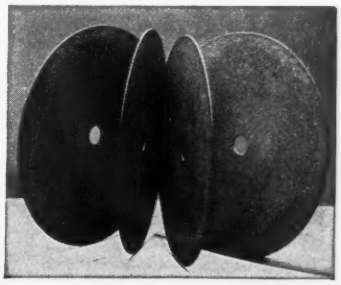

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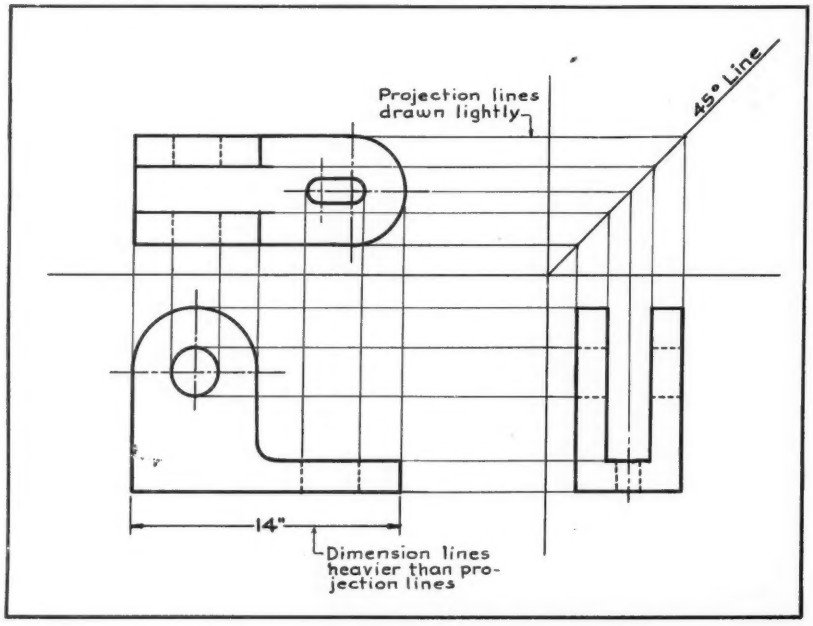
Are They Harmful?

BY *Mark B. Levinson*

Here is a contrasting viewpoint on teaching drawing to that of Benjamin J. Stern as expressed in the December issue of SCHOOL SHOP. Mark B. Levinson teaches mechanical drawing at the Carl Schurz Evening High School, Chicago, Illinois.

WITH reference to the article captioned, "Harmful Methods in Teaching Drafting," which appeared in the December 1943, issue of SCHOOL SHOP, I do not agree with the author in many respects; and, since the editor invites expression of opinion on this subject, I feel free to express my viewpoints, with due respect to the author.

The article deals for the most part with the use (or misuse) of the conventional projection lines which are used to draw the various views of an object. The author suggests the use of the dividers instead of these projection lines. We know that there is more to mechanical drawing than simple orthographic projection, which is the representation of an object in two or more views on planes at right angles to each other. I question any draftsman's ability to make isometric or perspective drawings, intersections of solids, developments, auxiliary views, etc., without the use of projection lines.



Projection lines are merely guide lines. They follow a point on the object to its relative position on other views. It is true that these lines are not needed on the finished drawing, yet, during the preparation of the drawing, even the advanced student must use them to follow through or retrace his projections. I teach students to draw these lines very lightly, just visible, but considerably thinner than dimension lines. In this way they cannot confuse the student or make an unsightly drawing.

Regarding the "transfer arcs" and other methods used in projection, I have found that the most satisfactory system is the one using a single 45° line, projecting horizontally and vertically to it. The accompanying drawing illustrates this. I believe this is much simpler than spreading the dividers, measuring each line separately, and transfering them to the other views. Beginning students usually have difficulty in getting accustomed to the proper use of the dividers, digging large holes in the paper, and accidently spreading them while in use, thus causing inaccuracies.

The beginning student is not taught to divide his drawing into four equal parts, but to divide his sheet in order to get four equal spaces for four different problems. He is taught the relative positions of the horizontal and vertical planes. Showing these planes naturally divides the drawing into four parts, but not necessarily equal parts. Simple arithmetic and a little sketch on scratch

(*Continued on page* 23)

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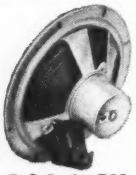

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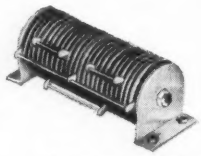

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BY *N. H. Poole*

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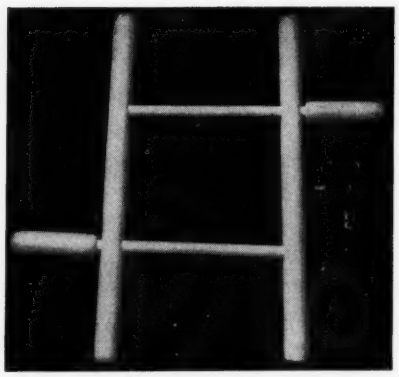

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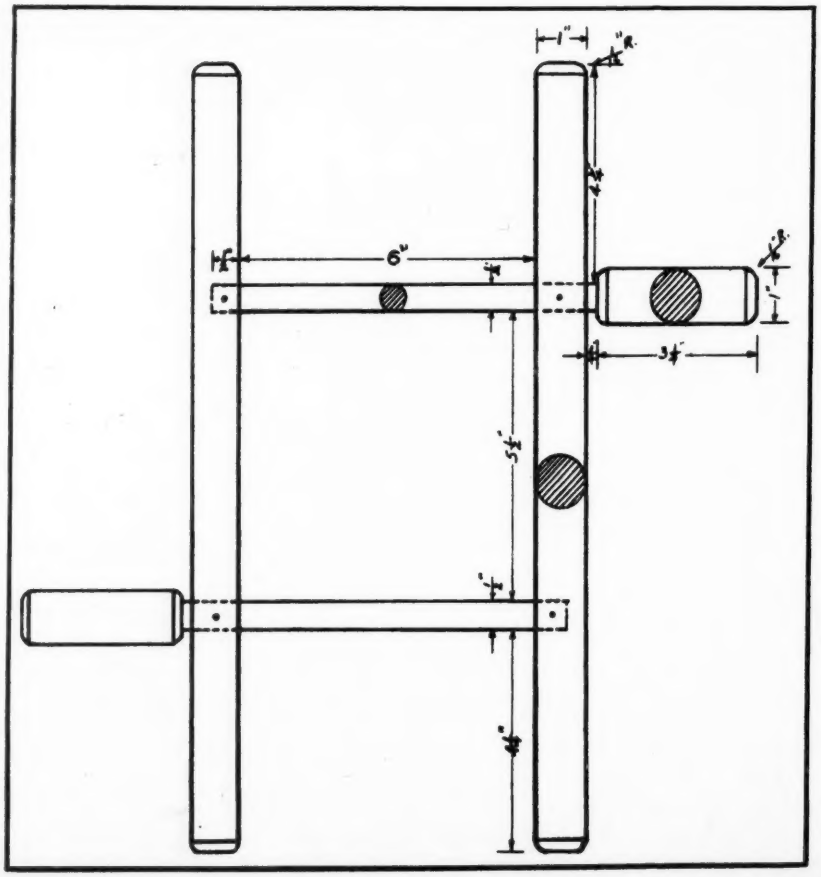

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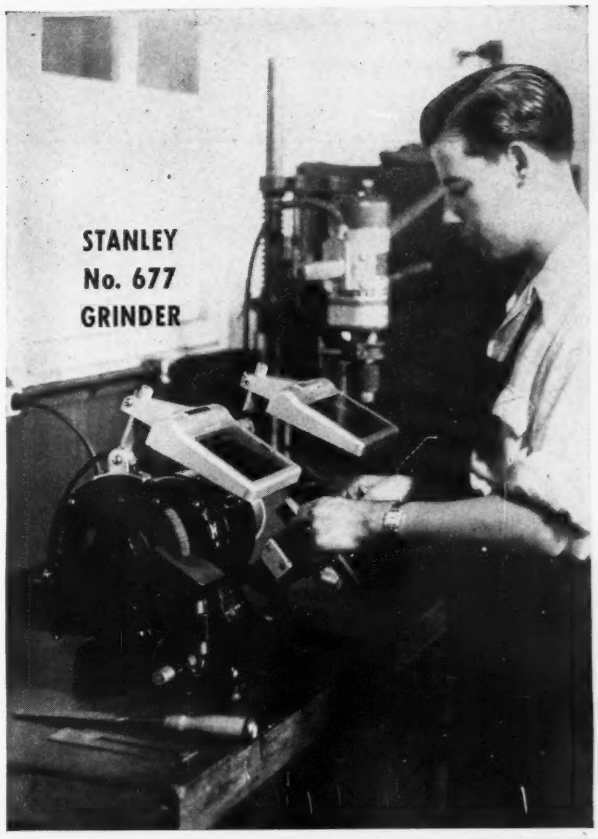

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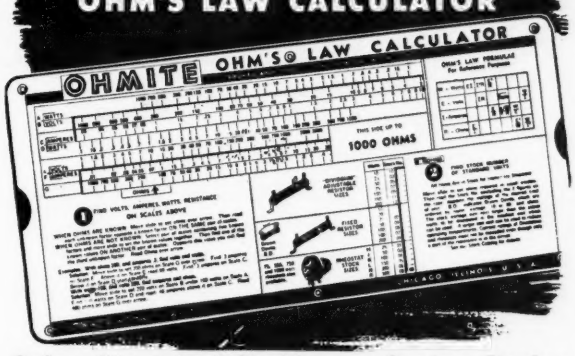

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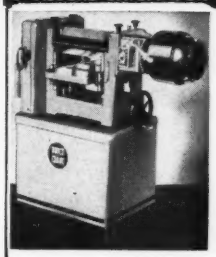

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Plastics. DuBois. Chicago: American Technical Society, 1943. (Revised.) Pp. xiv+434. $3.75.

Chapters on synthetic rubber and on developments in the low-pressure laminating field are important additions to this book on plastics. Though easily read, the book contains basic and useful knowledge concerning the plastics, their history, origin, and raw material sources, their physical, chemical, and electrical properties, and their limitations; methods of their fabrication and essential information about their design. Written as a textbook for schools and as a reference handbook for designers of plastic objects.

J. H. DuBois, of the Plastics Department of the General Electric Company, has spent 14 years in engineering and designing products made of every type of plastic material.

Industrial Arts in Utah—Course of Study. Logan, Utah: Utah State Agricultural College, 1941. Pp. 506. Paper bound, mimeographed.

The second of two manuals issued by the Utah State Department of Public Instruction. Course outlines for the teacher in the major industrial arts fields of drawing, auto mechanics, woodworking, general metals, silk-screen printing, plastics, power mechanics, electricity and radio, home mechanics, etc. Each chapter contains a list of the fundamental operations, the objectives, teaching aids, suitable projects, references, and suggestive method of approach. Prepared by a committee of industrial arts teachers at the 1941 summer session.

Precision Inspection. Washburne Curriculum Bureau. Chicago: Washburne Trade School Press, 1943. Pp. 99. Paper bound, mimeographed.

A war-production training manual, this book presents information on inspection instruments, a series of assignments involving the actual use of the various types of measuring tools, and a review of mathematical principles necessary for precision inspection. An *Instructor's Manual for Precision Inspection*, for use with this student's handbook, contains drawings and instructions for the preparation of materials to be measured in the assigned projects.

Using Tools. Shultz. Gainesville, Fla.: Florida Curriculum Laboratory, College of Education, University of Florida, 1943. Pp. 123. Paper bound, mimeographed. $.35.

A workbook designed for an elementary course in the use of tools to improve the home, with social and economic implications. Prepared to give practical construction activity to parallel reading about housing. Sketches. Suggestions for teachers.

Practical Wood Patternmaking. Hall. New York: McGraw-Hill Book Co., 1943. Pp. ix+188. $3.00.

From more than 30 years of patternmaking the author has evolved this working textbook, which proceeds from simple blueprint reading and terminology to construction of simple patterns and finally to more complex ones, in which the learner must begin to estimate time and materials required for their construction. Specific phases of patternmaking covered are preparation and use of glues, kinds of woods used, laying out and cutting round and square holes, care of tools, making cores, etc.

J. Robert Hall is instructor of patternmaking and foundry, Santa Monica Technical School, California.

PAMPHLETS:

Shipfitting Simplified by L. L. Oberman discusses the ship and its construction, prefabrication of units and assemblies, and tools used. Explanation of symbols and of shipbuilding terms. List of common abbreviations. Discussions of safety, promotions on job, routine building procedures. Index. $1.25, McGraw-Hill Book Co., 330 W. 42nd St., New York, N.Y.

Trail Blazers to Radionics and **Reference Guide to Ultra High Frequencies.** Kelsey, Chicago: Zenith Radio Corp., 1943. Pp. 29+56. Paper bound. Available on request for use in schools. Part I presents biographies of great men of science (from Pythagoras to Einstein) and tells how their contributions are now used in the progress of science, particularly radionics. Part II (third edition, revised) is a bibliography of books and articles on ultra high frequencies and the technics involved, the first edition of which provided much of the academic background for radar research.

Twenty-five Jigsaw Projects. Chicago: Science and Mechanics, 154 East Erie Street. Pp. 48. Paper bound. $.25. An introductory section containing information on correct operating methods and how to sand and file with the jigsaw precedes the 25 project descriptions.

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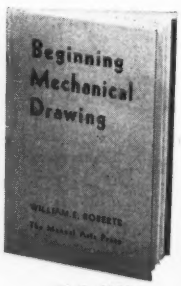

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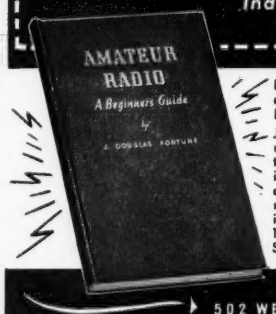

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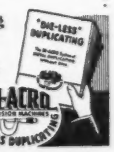

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From WASHINGTON by MICHAEL PACA

THERE is good news from Washington this month and each of the three major news items has a cheering overtone.

Release of equipment for industrial arts shops is a signpost on the road back to peace.

The American Vocational Association's decision to begin an active campaign for area vocational schools shows that Washington has vision which pierces through to the peace years ahead.

Revamping of the Thomas Bill (S. 1509), to retrain veterans, so as to insure absolute state and local control of the billion-dollar program, is an index of the strength of vocational education in the Nation's capital—strength to make certain that no encroachments will be tolerated against traditional educational rights.

● A bulletin now on the press for the AVA* promises to bring out into the open for the first time in Washington the whole problem of area vocational schools. Your reporter has seen an advance copy of this document—which will probably provoke not only much thought and discussion but even acrimonious debate. For area vocational schools, your reporter has found, is a fighting phrase. Some conservative national law-makers are apt to regard them as a "device which would cause more federal money to pour from the debt-burdened federal treasury into the states." Organized labor's suspicion flares at the mention of the phrase because unions fear the "influx of surplus craftsmen" into its ranks. Most surprising is the opposition your reporter found among "general education" officials. One Washington executive, near the very top in education, expressed fear that area schools "will wreck the small high schools by draining off from them more capable rural children." We shall probably hear more opposing arguments from this source.

But facts do not yield to arguments. And as the AVA bulletin shows, the tragic fact for America is that vocational education has up to now been reserved for only that half of the population living in larger cities. "Broad vocational programs do not exist either in rural areas or in most small cities, although rural and village schools comprise the great majority of school units in the United States."

The public schools, argues the AVA, must therefore be expanded in administrative pattern and support to provide more complete plans of vocational education for the rural area. In the pattern of expansion might be included: (1) new departments or classes in schools where vocational education is not feasible under the national vocational acts; (2) short-term and special classes of seasonal or special nature; (3) cooperation among schools for interchanging pupils to attend vocational courses, if transportation permits; (4) larger schools, which would draw students from large surrounding areas; and (5) technical institutes offering instruction for highly specialized types of work.

The last two items in this list are the explosive ones, because they break the narrow mold in which education has heretofore been cast. The larger area school or institute would serve not only a group of communities, but even a group of counties or portions of two or more states. But local school authorities need not fear that the AVA proposes disturbing established lines of control. The AVA believes that the new plans it proposes can, for the most part, *be built right into the existing school systems;* that area schools can be run by local authorities without too much adjustment; and that many existing schools may become special area units by providing vocational training opportunities required by the youth and adults of the area.

Nevertheless, area schools and vocational institutes will raise a host of questions regarding federal support; supplementary legislation to the Smith-Hughes and George-Deen Acts; methods used in locating the schools; transportation; teacher preparation and supervision in situations which cut across states lines; and financial help or scholarships to needy students.

But reading the AVA bulletin one has confidence that the leadership of vocational education will meet and solve these problems. For, vocational education has vision and a new determination to bring its benefits to the "untouched areas" and excluded children and adults of our nation.

● Following a survey of industrial arts shop needs, made by the War Production Board and the U. S. Office of Education, officials have come to the conclusion that the industrial arts field has been discriminated against too severely insofar as priorities for equipment are concerned. And because American industry is now over the hump in its war-production schedules, officials decided that applications for metal- and woodworking equipment under $350 should be given "favorable consideration," if industrial arts departments prove their need. Equipment costing more than $350 is still "critical." And begs the WPB: "Apply for priorities before going to the supplier. Anticipate your needs. Who knows? By March 1, the whole situation may change."

This last injunction is a hint that if the scheduled invasion of Europe does not go well at first, or if our armies

(*Continued on page* 23)

An Enlarged Program of Vocational Education with Special Reference to Larger Administrative Units, prepared by the Committee on Research of the AVA, will be released about mid-February. Write to the American Vocational Association, Washington, D.C. Single copies, 40c.

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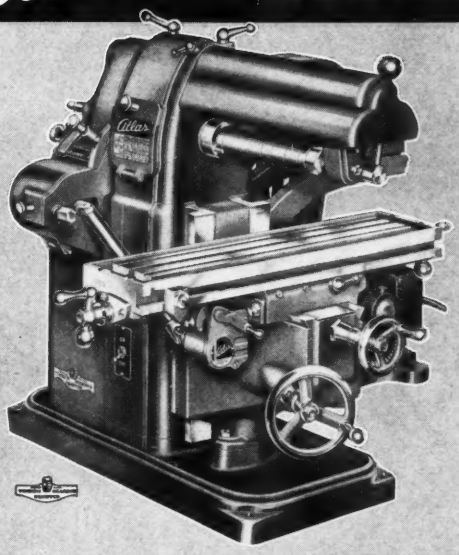

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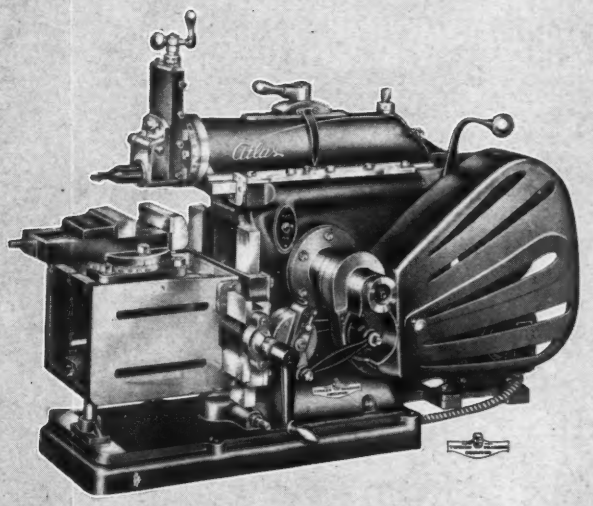

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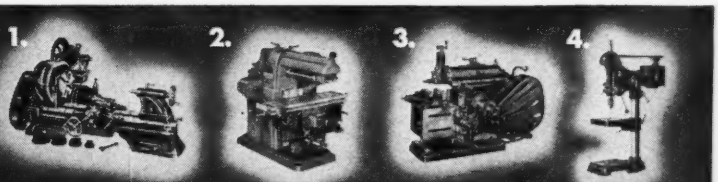
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